

A wide band backend for Radio Astronomy in Robledo

Description and commissioning results

J. Ricardo Rizzo

Centro de Astrobiología

December 21, 2011



The team



The team



- CAB:

- INTA:

The team



- CAB:

- José Cernicharo
- Miguel Gutiérrez
- Ricardo Rizzo

- INTA:

The team



- CAB:

- José Cernicharo
- Miguel Gutiérrez
- Ricardo Rizzo

- INTA:

The team



- CAB:
 - José Cernicharo
 - Miguel Gutiérrez
 - Ricardo Rizzo
- INTA:
 - Ana Baquero
 - Juan Ramón Larrañaga
 - Laura Ojalvo
 - Antonio Pedreira

The team



- CAB:

- José Cernicharo
- Miguel Gutiérrez
- Ricardo Rizzo

- INTA:

- Ana Baquero
- Juan Ramón Larrañaga
- Laura Ojalvo
- Antonio Pedreira

- MDSCC:

- David Calvo
- José M. Castro-Carrizosa
- Cristina Cerna-Rodríguez
- Iván Sánchez
- Manuel Baquero

- JPL/NASA:

- Manuel Franco
- Tom Rector

The team



- CAB:

- José Cernicharo
- Miguel Gutiérrez
- Ricardo Rizzo

- INTA:

- Ana Baquero
- Juan Ramón Larrañaga
- Laura Ojalvo
- Antonio Pedreira

- MDSCC:

- David Calvo
- José M. Castro-Carrizosa
- Cristina Cordero
- María Domínguez
- Manuel Esteguer

- JPL/NASA:

- Manuel Parro
- Tom Rector

The team



- CAB:

- José Cernicharo
- Miguel Gutiérrez
- Ricardo Rizzo

- INTA:

- Ana Baquero
- Juan Ramón Larrañaga
- Laura Ojalvo
- Antonio Pedreira

- MDSCC:

- David Calvo
- José M. Castro-Carrizosa
- Cristina Cordero
- María Domercq
- Manuel López

- JPL/NASA:

- Manuel Paricio
- Tom Rector

The team



- CAB:

- José Cernicharo
- Miguel Gutiérrez
- Ricardo Rizzo

- INTA:

- Ana Baquero
- Juan Ramón Larrañaga
- Laura Ojalvo
- Antonio Pedreira

- MDSCC:

- David Calvo
- José M. Carrón Carrón
- Carlos Carrón
- María Sánchez
- Manuel Baquero

- JPL/NASA:

- Manuel Roca
- Tom Rector

The team



- CAB:
 - José Cernicharo
 - Miguel Gutiérrez
 - Ricardo Rizzo
- INTA:
 - Ana Baquero
 - Juan Ramón Larrañaga
 - Laura Ojalvo
 - Antonio Pedreira

- MDSCC:
 - David Calonge
 - José M. García-González
 - Carlos Gómez
 - María Rodríguez
 - Manuel Rodríguez
- JPL/NASA:
 - María Riquelme
 - Tom Rector

The team



- CAB:
 - José Cernicharo
 - Miguel Gutiérrez
 - Ricardo Rizzo
- INTA:
 - Ana Baquero
 - Juan Ramón Larrañaga
 - Laura Ojalvo
 - Antonio Pedreira

The team



- CAB:

- José Cernicharo
- Miguel Gutiérrez
- Ricardo Rizzo

- INTA:

- Ana Baquero
- Juan Ramón Larrañaga
- Laura Ojalvo
- Antonio Pedreira

- MDSCC:

- Jesús Calvo
- José M. Castro Cerón
- Cristina García Miró
- Ioana Sotuela
- Manuel Vázquez

- JPL/NASA:

- Manuel Franco
- Tom Kuiper

The team



- CAB:
 - José Cernicharo
 - Miguel Gutiérrez
 - Ricardo Rizzo
- INTA:
 - Ana Baquero
 - Juan Ramón Larrañaga
 - Laura Ojalvo
 - Antonio Pedreira

The team



- CAB:
 - José Cernicharo
 - Miguel Gutiérrez
 - Ricardo Rizzo
- INTA:
 - Ana Baquero
 - Juan Ramón Larrañaga
 - Laura Ojalvo
 - Antonio Pedreira

The team



- CAB:
 - José Cernicharo
 - Miguel Gutiérrez
 - Ricardo Rizzo
- INTA:
 - Ana Baquero
 - Juan Ramón Larrañaga
 - Laura Ojalvo
 - Antonio Pedreira

The team



- CAB:

- José Cernicharo
- Miguel Gutiérrez
- Ricardo Rizzo

- INTA:

- Ana Baquero
- Juan Ramón Larrañaga
- Laura Ojalvo
- Antonio Pedreira

- MDSCC:

- Jesús Calvo
- José M. Castro Cerón
- Cristina García Miró
- Ioana Sotuela
- Manuel Vázquez

- JPL/NASA:

- Manuel Franco
- Tom Kuiper

The team



- CAB:
 - José Cernicharo
 - Miguel Gutiérrez
 - Ricardo Rizzo
- INTA:
 - Ana Baquero
 - Juan Ramón Larrañaga
 - Laura Ojalvo
 - Antonio Pedreira

The team



- CAB:
 - José Cernicharo
 - Miguel Gutiérrez
 - Ricardo Rizzo
- INTA:
 - Ana Baquero
 - Juan Ramón Larrañaga
 - Laura Ojalvo
 - Antonio Pedreira

The team



- CAB:
 - José Cernicharo
 - Miguel Gutiérrez
 - Ricardo Rizzo
- INTA:
 - Ana Baquero
 - Juan Ramón Larrañaga
 - Laura Ojalvo
 - Antonio Pedreira

The team



- CAB:
 - José Cernicharo
 - Miguel Gutiérrez
 - Ricardo Rizzo
- INTA:
 - Ana Baquero
 - Juan Ramón Larrañaga
 - Laura Ojalvo
 - Antonio Pedreira

The team



- CAB:

- José Cernicharo
- Miguel Gutiérrez
- Ricardo Rizzo

- INTA:

- Ana Baquero
- Juan Ramón Larrañaga
- Laura Ojalvo
- Antonio Pedreira

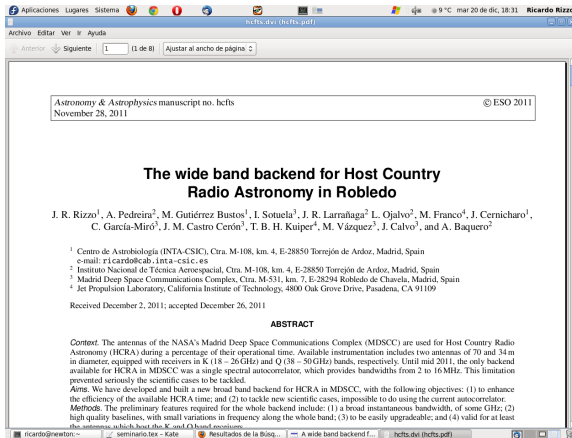
- MDSCC:

- Jesús Calvo
- José M. Castro Cerón
- Cristina García Miró
- Ioana Sotuela
- Manuel Vázquez

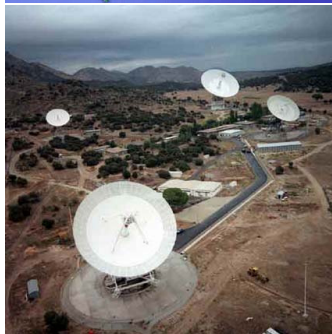
- JPL/NASA:

- Manuel Franco
- Tom Kuiper

Paper's coming

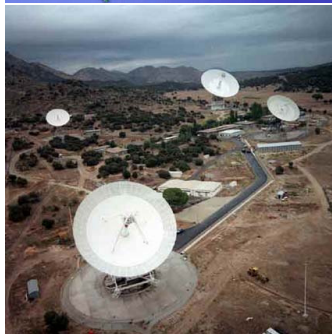


What's Host Country RA?



- NASA tracks “Deep Space” missions using: Goldstone, Canberra, Robledo.
- In Robledo, there are 6 antennas having diameters between 26 and 70 m.
- International agreement: Spain operates antennas as radiotelescopes.
- 200 – 400 hr/yr/antenna in service mode.
- Spanish investigador required.

What's Host Country RA?



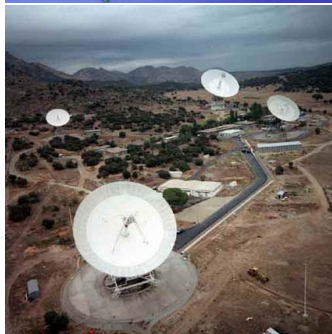
- NASA tracks “Deep Space” missions using: Goldstone, Canberra, Robledo.
- In Robledo, there are 6 antennas having diameters between 26 and 70 m.
- International agreement: Spain operates antennas as radiotelescopes.
- 200 – 400 hr/yr/antenna in service mode.
- Spanish investigador required.

What's Host Country RA?



- NASA tracks “Deep Space” missions using: Goldstone, Canberra, Robledo.
- In Robledo, there are 6 antennas having diameters between 26 and 70 m.
- International agreement: Spain operates antennas as radiotelescopes.
- 200 – 400 hr/yr/antenna in service mode.
- Spanish investigador required.

What's Host Country RA?



- NASA tracks “Deep Space” missions using: Goldstone, Canberra, Robledo.
- In Robledo, there are 6 antennas having diameters between 26 and 70 m.
- International agreement: Spain operates antennas as radiotelescopes.
- 200 – 400 hr/yr/antenna in service mode.
- Spanish investigador required.

What's Host Country RA?



- NASA tracks “Deep Space” missions using: Goldstone, Canberra, Robledo.
- In Robledo, there are 6 antennas having diameters between 26 and 70 m.
- International agreement: Spain operates antennas as radiotelescopes.
- 200 – 400 hr/yr/antenna in service mode.
- Spanish investigador required.

What's Host Country RA?



- NASA tracks “Deep Space” missions using: Goldstone, Canberra, Robledo.
- In Robledo, there are 6 antennas having diameters between 26 and 70 m.
- International agreement: Spain operates antennas as radiotelescopes.
- 200 – 400 hr/yr/antenna in service mode.
- Spanish investigador required.

What's Host Country RA?



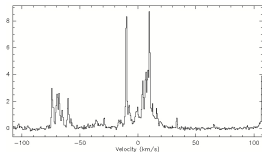
- NASA tracks “Deep Space” missions using: Goldstone, Canberra, Robledo.
- In Robledo, there are 6 antennas having diameters between 26 and 70 m.
- International agreement: Spain operates antennas as radiotelescopes.
- 200 – 400 hr/yr/antenna in service mode.
- Spanish investigador required.

What's Host Country RA?



- NASA tracks “Deep Space” missions using: Goldstone, Canberra, Robledo.
- In Robledo, there are 6 antennas having diameters between 26 and 70 m.
- International agreement: Spain operates antennas as radiotelescopes.
- 200 – 400 hr/yr/antenna in service mode.
- Spanish investigador required.

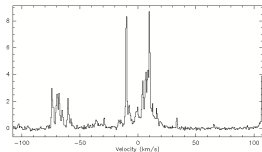
What science can we do?



- DSS-63, 70m. K band.
18 – 26 GHz.
- DSS-54, 34m. Q band.
38 – 50 GHz.
- Some key molecules: H_2O , NH_3 ,
 CCS , CS , SiO , CH_3OH , HC_{2n+1}N ,
carbon chains, etc.
- Star forming regions, evolved stars,
ISM, CSM, PDRs, Solar System,
cold clouds, extragalactic, etc.
- Spectral line surveys. Chemical
complexity.
- Any (yet) unexplored scientific

cases

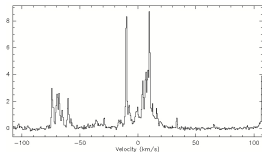
What science can we do?



- DSS-63, 70m. K band.
18 – 26 GHz.
- DSS-54, 34m. Q band.
38 – 50 GHz.
- Some key molecules: H_2O , NH_3 ,
 CCS , CS , SiO , CH_3OH , HC_{2n+1}N ,
carbon chains, etc.
- Star forming regions, evolved stars,
ISM, CSM, PDRs, Solar System,
cold clouds, extragalactic, etc.
- Spectral line surveys. Chemical
complexity.
- Any (yet) unexplored scientific

cases

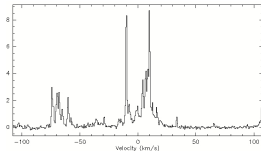
What science can we do?



- DSS-63, 70m. K band.
18 – 26 GHz.
- DSS-54, 34m. Q band.
38 – 50 GHz.
- Some key molecules: H_2O , NH_3 , CCS , CS , SiO , CH_3OH , HC_{2n+1}N , carbon chains, etc.
- Star forming regions, evolved stars, ISM, CSM, PDRs, Solar System, cold clouds, extragalactic, etc.
- Spectral line surveys. Chemical complexity.
- Any (yet) unexplored scientific

cases.

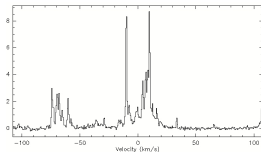
What science can we do?



- DSS-63, 70m. K band.
18 – 26 GHz.
- DSS-54, 34m. Q band.
38 – 50 GHz.
- Some key molecules: H_2O , NH_3 , CCS , CS , SiO , CH_3OH , HC_{2n+1}N , carbon chains, etc.
- Star forming regions, evolved stars, ISM, CSM, PDRs, Solar System, cold clouds, extragalactic, etc.
- Spectral line surveys. Chemical complexity.
- Any (yet) unexplored scientific

cases.

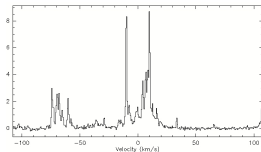
What science can we do?



- DSS-63, 70m. K band.
18 – 26 GHz.
- DSS-54, 34m. Q band.
38 – 50 GHz.
- Some key molecules: H_2O , NH_3 , CCS , CS , SiO , CH_3OH , HC_{2n+1}N , carbon chains, etc.
- Star forming regions, evolved stars, ISM, CSM, PDRs, Solar System, cold clouds, extragalactic, etc.
- Spectral line surveys. Chemical complexity.
- Any (yet) unexplored scientific

cases.

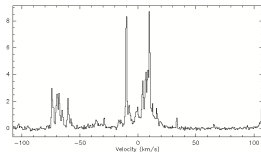
What science can we do?



- DSS-63, 70m. K band.
18 – 26 GHz.
- DSS-54, 34m. Q band.
38 – 50 GHz.
- Some key molecules: H_2O , NH_3 , CCS , CS , SiO , CH_3OH , HC_{2n+1}N , carbon chains, etc.
- Star forming regions, evolved stars, ISM, CSM, PDRs, Solar System, cold clouds, extragalactic, etc.
- Spectral line surveys. Chemical complexity.
- Any (yet) unexplored scientific

cases.

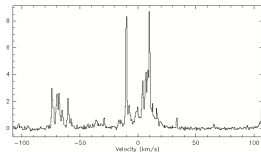
What science can we do?



- DSS-63, 70m. K band.
18 – 26 GHz.
- DSS-54, 34m. Q band.
38 – 50 GHz.
- Some key molecules: H_2O , NH_3 , CCS , CS , SiO , CH_3OH , HC_{2n+1}N , carbon chains, etc.
- Star forming regions, evolved stars, ISM, CSM, PDRs, Solar System, cold clouds, extragalactic, etc.
- Spectral line surveys. Chemical complexity.
- Any (yet) unexplored scientific

cases.

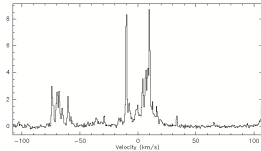
What science can we do?



- DSS-63, 70m. K band.
18 – 26 GHz.
- DSS-54, 34m. Q band.
38 – 50 GHz.
- Some key molecules: H_2O , NH_3 , CCS , CS , SiO , CH_3OH , HC_{2n+1}N , carbon chains, etc.
- Star forming regions, evolved stars, ISM, CSM, PDRs, Solar System, cold clouds, extragalactic, etc.
- Spectral line surveys. Chemical complexity.
- Any (yet) unexplored scientific

cases.

What science can we do?



- DSS-63, 70m. K band.
18 – 26 GHz.
- DSS-54, 34m. Q band.
38 – 50 GHz.
- Some key molecules: H_2O , NH_3 , CCS , CS , SiO , CH_3OH , HC_{2n+1}N , carbon chains, etc.
- Star forming regions, evolved stars, ISM, CSM, PDRs, Solar System, cold clouds, extragalactic, etc.
- Spectral line surveys. Chemical complexity.
- Any (yet) unexplored scientific cases.

The bottlenecks



- Total available time. Up to 400 hr/yr/antenna.
- Scheduling & emergencies.
- Available (untill 2011) backend.
2 to 16 MHz bandwidth:

• just one line
• just one polarization
• sometimes poor
spectral coverage

The bottlenecks



- Total available time. Up to 400 hr/yr/antenna.
- Scheduling & emergencies.
- Available (untill 2011) backend.
2 to 16 MHz bandwidth:

• just one line
• just one polarization
• sometimes poor
spectral coverage

The bottlenecks



- Total available time. Up to 400 hr/yr/antenna.
- Scheduling & emergencies.
- Available (untill 2011) backend.
2 to 16 MHz bandwidth:
 - *just one line,*
 - *just one polarization,*
 - *sometimes poor spectral coverage.*

The bottlenecks



- Total available time. Up to 400 hr/yr/antenna.
- Scheduling & emergencies.
- Available (untill 2011) backend.
2 to 16 MHz bandwidth:
 - *just one line,*
 - *just one polarization,*
 - *sometimes poor spectral coverage.*

The bottlenecks



The bottlenecks



- Total available time. Up to 400 hr/yr/antenna.
- Scheduling & emergencies.
- Available (untill 2011) backend.
2 to 16 MHz bandwidth:
 - *just one line,*
 - *just one polarization,*
 - *sometimes poor spectral coverage.*

The bottlenecks



- Total available time. Up to 400 hr/yr/antenna.
- Scheduling & emergencies.
- Available (untill 2011) backend.
2 to 16 MHz bandwidth:
 - *just one line,*
 - *just one polarization,*
 - *sometimes poor spectral coverage.*

The bottlenecks



- Total available time. Up to 400 hr/yr/antenna.
- Scheduling & emergencies.
- Available (untill 2011) backend.
2 to 16 MHz bandwidth:
 - *just one line,*
 - *just one polarization,*
 - *sometimes poor spectral coverage.*

The bottlenecks



- Total available time. Up to 400 hr/yr/antenna.
- Scheduling & emergencies.
- Available (untill 2011) backend.
2 to 16 MHz bandwidth:
 - *just one line,*
 - *just one polarization,*
 - *sometimes poor spectral coverage.*

Aims and features

Aims

- To enhance the efficiency of HC time at MDSCC, improving its scientific return.
- To tackle new scientific cases using HC.

Features

- Broad instantaneous bandwidth, at least several GHz.
- High quality baselines.
- Easily upgradeable.
- Portable among different antennas.
- Reusable.

Aims and features

Aims

- To enhance the **efficiency** of HC time at MDSCC, improving its scientific return.
- To tackle **new scientific cases** using HC.

Features

- **Broad instantaneous bandwidth**, at least several GHz.
- High quality **baselines**.
- Easily upgradeable.
- Portable among different antennas.
- **Reusable**.

Aims and features

Aims

- To enhance the **efficiency** of HC time at MDSCC, improving its scientific return.
- To tackle **new scientific cases** using HC.

Features

- Broad instantaneous bandwidth, at least several GHz.
- High quality **baselines**.
- Easily upgradeable.
- Portable among different antennas.
- Reusable.

Aims and features

Aims

- To enhance the **efficiency** of HC time at MDSCC, improving its scientific return.
- To tackle **new scientific cases** using HC.

Features

- Broad instantaneous bandwidth, at least several GHz.
- High quality **baselines**.
- Easily upgradeable.
- Portable among different antennas.
- Reusable.

Aims and features

Aims

- To enhance the **efficiency** of HC time at MDSCC, improving its scientific return.
- To tackle **new scientific cases** using HC.

Features

- **Broad instantaneous bandwidth**, at least several GHz.
- High quality **baselines**.
- Easily upgradeable.
- Portable among different antennas.
- **Reusable**.

Aims and features

Aims

- To enhance the **efficiency** of HC time at MDSCC, improving its scientific return.
- To tackle **new scientific cases** using HC.

Features

- **Broad instantaneous bandwidth**, at least several GHz.
- High quality **baselines**.
- Easily upgradeable.
- Portable among different antennas.
- **Reusable**.

Aims and features

Aims

- To enhance the **efficiency** of HC time at MDSCC, improving its scientific return.
- To tackle **new scientific cases** using HC.

Features

- **Broad instantaneous bandwidth**, at least several GHz.
- High quality **baselines**.
- Easily upgradeable.
- Portable among different antennas.
- Reusable.

Aims and features

Aims

- To enhance the **efficiency** of HC time at MDSCC, improving its scientific return.
- To tackle **new scientific cases** using HC.

Features

- **Broad instantaneous bandwidth**, at least several GHz.
- High quality **baselines**.
- Easily upgradeable.
- Portable among different antennas.
- Reusable.

Aims and features

Aims

- To enhance the **efficiency** of HC time at MDSCC, improving its scientific return.
- To tackle **new scientific cases** using HC.

Features

- **Broad instantaneous bandwidth**, at least several GHz.
- High quality **baselines**.
- Easily upgradeable.
- Portable among different antennas.

• Reusable.

Aims and features

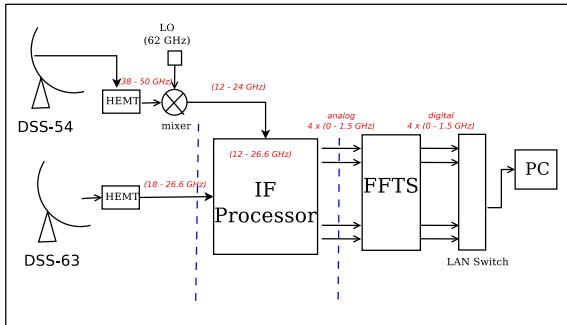
Aims

- To enhance the **efficiency** of HC time at MDSCC, improving its scientific return.
- To tackle **new scientific cases** using HC.

Features

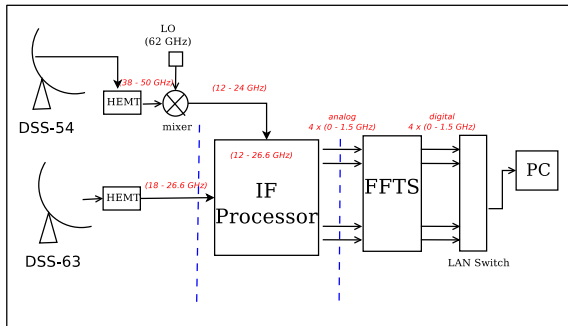
- **Broad instantaneous bandwidth**, at least several GHz.
- High quality **baselines**.
- Easily upgradeable.
- Portable among different antennas.
- Reusable.

Concept



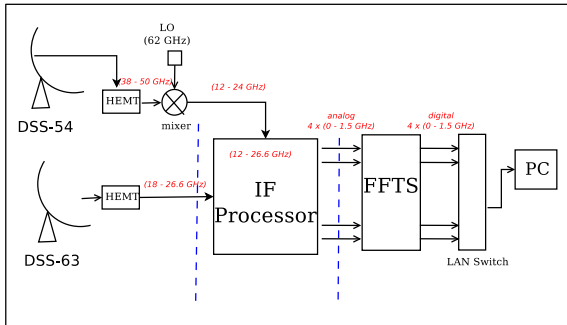
- Two polarizations.
- 4 x 1.5 GHz instantaneous bandwidth.
- Two IFs tunable at a time. Partly prepared for 4.
- Freq range from 12 to 26 GHz (valid for K and Q).

Concept



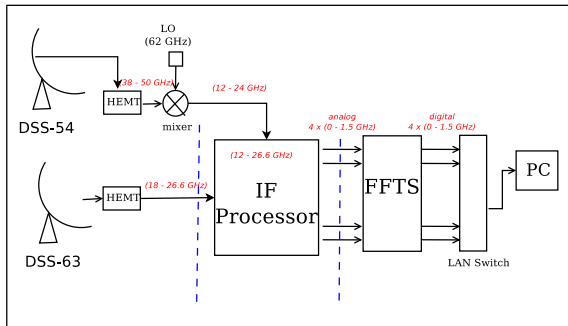
- Two polarizations.
- 4×1.5 GHz instantaneous bandwidth.
- Two IFs tunable at a time. Partly prepared for 4.
- Freq range from 12 to 26 GHz (valid for K and Q).

Concept



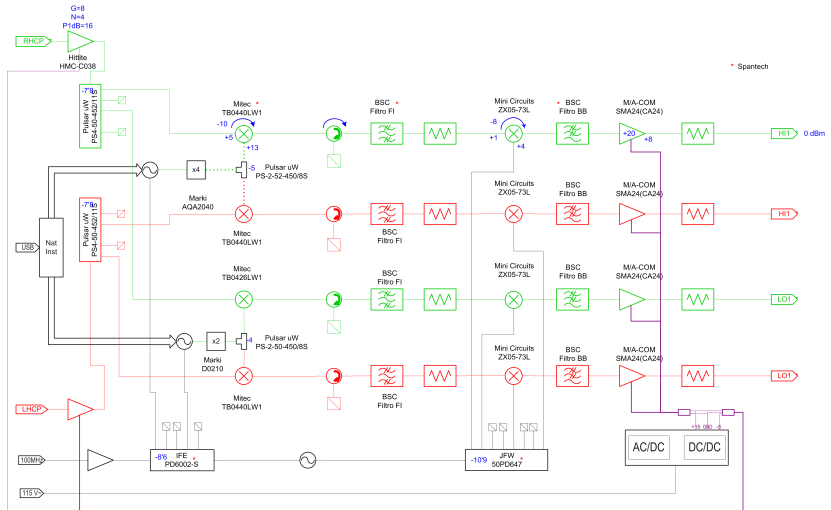
- Two polarizations.
- 4×1.5 GHz instantaneous bandwidth.
- Two IFs tunable at a time. Partly prepared for 4.
- Freq range from 12 to 26 GHz (valid for K and Q).

Concept



- Two polarizations.
- 4×1.5 GHz instantaneous bandwidth.
- Two IFs tunable at a time. Partly prepared for 4.
- Freq range from 12 to 26 GHz (valid for K and Q).

The IF Processor



The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - 2×10 (2 – 20 GHz)
 - 2×10 (10 – 26 GHz)
- IF 4.5 GHz.
- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - 2× LO (12 – 20 GHz)
 - 2× HI (18 – 26 GHz)
- IF 4.5 GHz.
- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - 2× LO (12 – 20 GHz)
 - 2× HI (18 – 26 GHz)
- IF 4.5 GHz.
- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - $2 \times$ LO (12 – 20 GHz)
 - $2 \times$ HI (18 – 26 GHz)
- IF 4.5 GHz.

- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - 2× LO (12 – 20 GHz)
 - 2× HI (18 – 26 GHz)
- IF 4.5 GHz.

- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - 2× LO (12 – 20 GHz)
 - 2× HI (18 – 26 GHz)
- IF 4.5 GHz.

- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - 2× LO (12 – 20 GHz)
 - 2× HI (18 – 26 GHz)
- IF 4.5 GHz.

- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - 2× LO (12 – 20 GHz)
 - 2× HI (18 – 26 GHz)
- IF 4.5 GHz.
- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - 2× LO (12 – 20 GHz)
 - 2× HI (18 – 26 GHz)
- IF 4.5 GHz.
- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

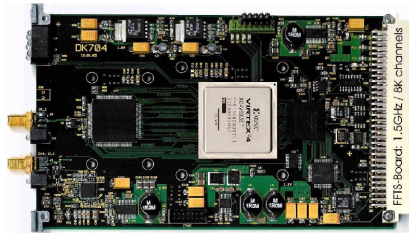
The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - 2× LO (12 – 20 GHz)
 - 2× HI (18 – 26 GHz)
- IF 4.5 GHz.
- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

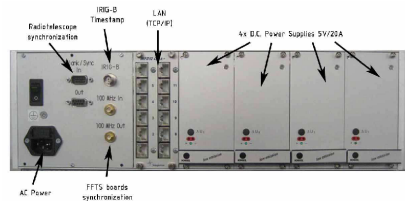
The IF Processor

- Designed and built at INTA's Radar Laboratory.
- Four channels:
 - $2 \times$ LO (12 – 20 GHz)
 - $2 \times$ HI (18 – 26 GHz)
- IF 4.5 GHz.
- Synthesizers controlled by serial ports.
- Input: Two RF signals in the range 12 – 26 GHz.
- Output: Four BB signals, 1.5 GHz instantaneous bandwidth.

The FFTS

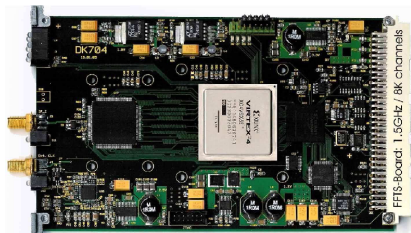


- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.

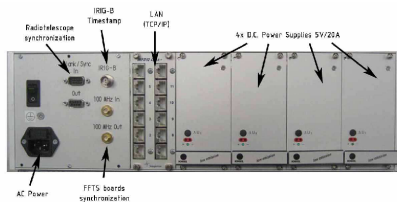


- 8192 channels,
183 kHz resolution.
- Other cores:

The FFTS

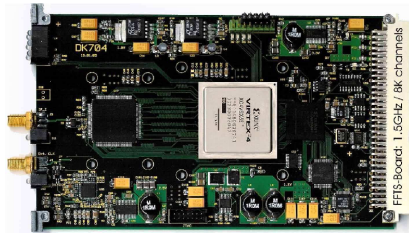


- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.

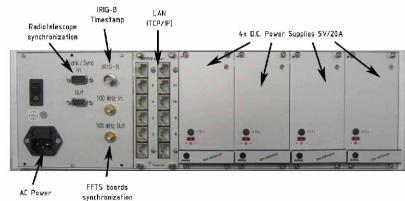


- 8192 channels,
183 kHz resolution.
- Other cores:

The FFTS

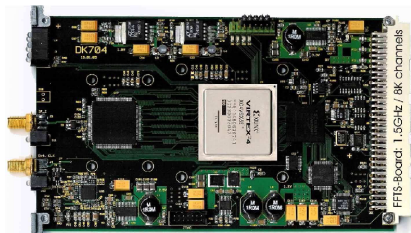


- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.

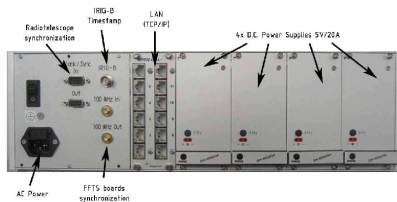


- 8192 channels,
183 kHz resolution.
- Other cores:

The FFTS

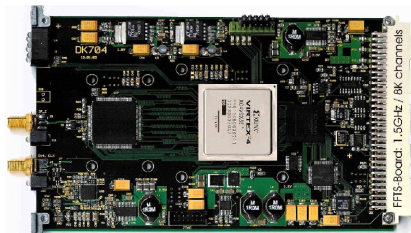


- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.

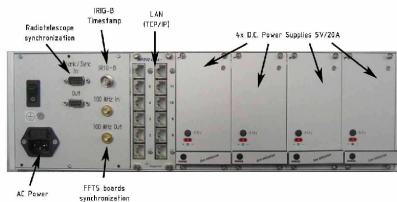


- 8192 channels,
183 kHz resolution.
- Other cores:

The FFTS

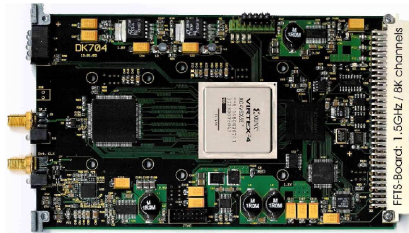


- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.

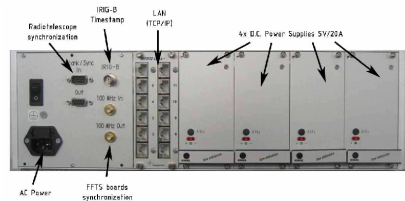


- 8192 channels,
183 kHz resolution.
- Other cores:

The FFTS

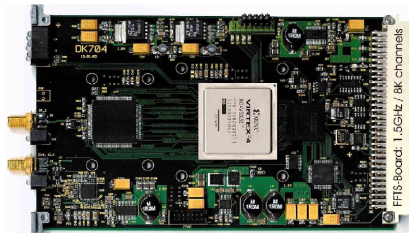


- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.

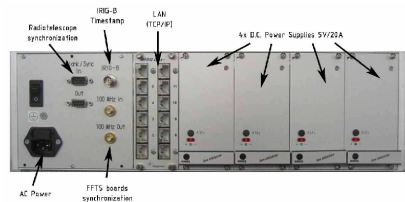


- 8192 channels,
183 kHz resolution.
- Other cores:

The FFTS

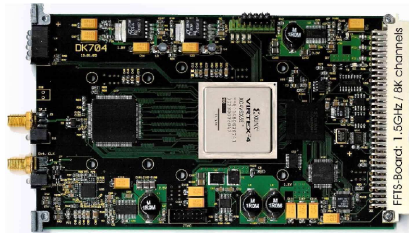


- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.

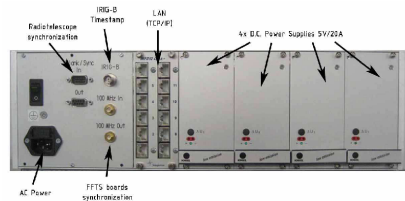


- 8192 channels,
183 kHz resolution.
- Other cores:
 - 500 MHz / 35 kHz
16384 channels
 - 100 MHz / 7 kHz
16384 channels

The FFTS



- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.

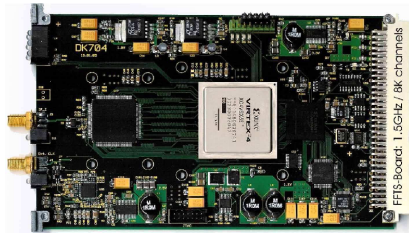


- 8192 channels,
183 kHz resolution.

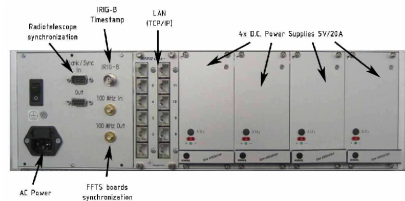
- Other cores:

- 500 MHz / 35 kHz
16384 channels
- 100 MHz / 7 kHz
16384 channels

The FFTS

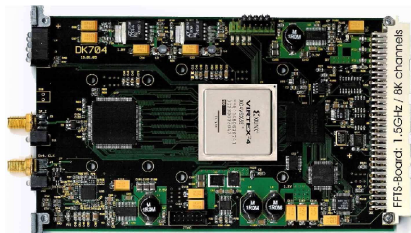


- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.

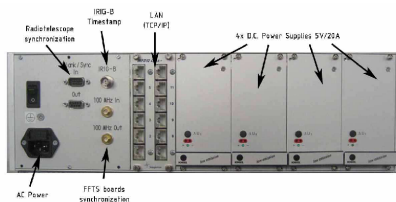


- 8192 channels, 183 kHz resolution.
- Other cores:
 - 500 MHz / 35 kHz
16384 channels
 - 100 MHz / 7 kHz
16384 channels

The FFTS

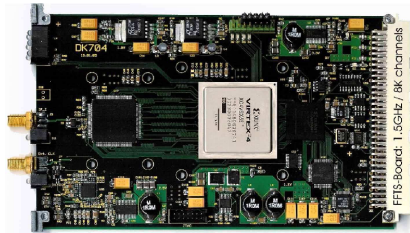


- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.

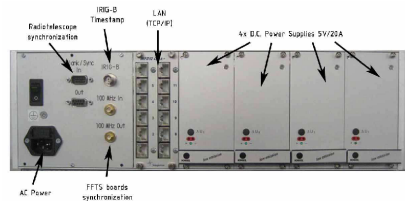


- 8192 channels,
183 kHz resolution.
- Other cores:
 - 500 MHz / 35 kHz
16384 channels
 - 100 MHz / 7 kHz
16384 channels

The FFTS

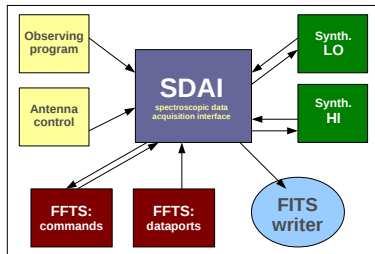


- FPGA-based. Chips virtex-4.
- Instantaneous bandwidth of 1.5 GHz.
- ADCs of 8 bits.
- Operated by ethernet.



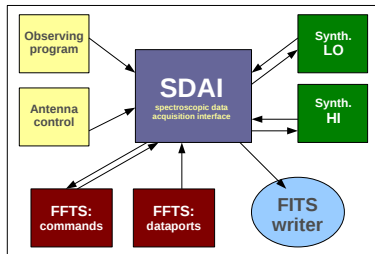
- 8192 channels,
183 kHz resolution.
- Other cores:
 - 500 MHz / 35 kHz
16384 channels
 - 100 MHz / 7 kHz
16384 channels

SDAI: Spectroscopic Data Acquisition Interface



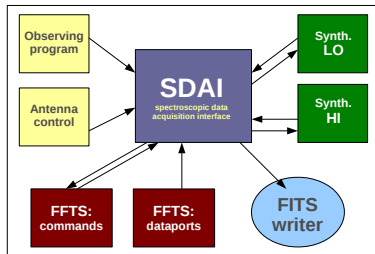
- Developed in python 2.5.
- PyQt4 for Graphical interface.
- Libraries provided: right now, only 1.5 GHz.
- Multicore coming soon.
- Fast, reliable.
- Synchronizes and centralizes all spectroscopic operations.
- Communications through sockets and USB.

SDAI: Spectroscopic Data Acquisition Interface



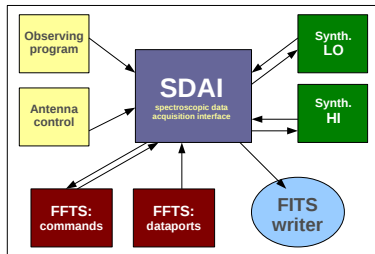
- Developed in python 2.5.
- PyQt4 for Graphical interface.
- Libraries provided: right now, only 1.5 GHz.
- Multicore coming soon.
- Fast, reliable.
- Synchronizes and centralizes all spectroscopic operations.
- Communications through sockets and USB.

SDAI: Spectroscopic Data Acquisition Interface



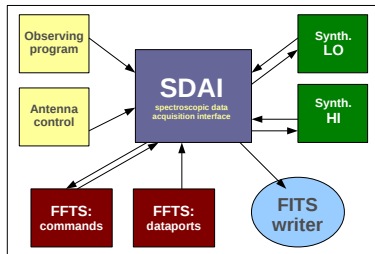
- Developed in python 2.5.
- PyQt4 for Graphical interface.
- Libraries provided: right now, only 1.5 GHz.
- Multicore coming soon.
- Fast, reliable.
- Synchronizes and centralizes all spectroscopic operations.
- Communications through sockets and USB.

SDAI: Spectroscopic Data Acquisition Interface



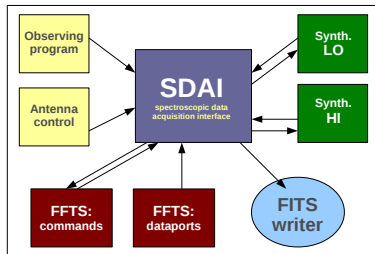
- Developed in python 2.5.
- PyQt4 for Graphical interface.
- Libraries provided: right now, only 1.5 GHz.
- Multicore coming soon.
- Fast, reliable.
- Synchronizes and centralizes all spectroscopic operations.
- Communications through sockets and USB.

SDAI: Spectroscopic Data Acquisition Interface



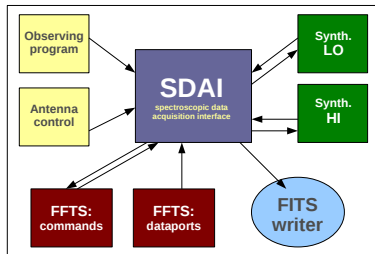
- Developed in python 2.5.
- PyQt4 for Graphical interface.
- Libraries provided:
right now, only 1.5 GHz.
- Multicore coming soon.
- Fast, reliable.
- Synchronizes and centralizes all spectroscopic operations.
- Communications through sockets and USB.

SDAI: Spectroscopic Data Acquisition Interface



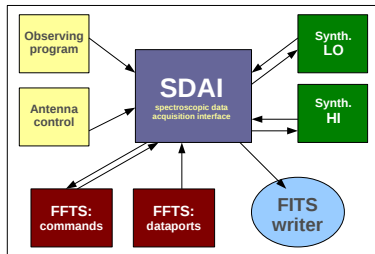
- Developed in python 2.5.
- PyQt4 for Graphical interface.
- Libraries provided: right now, only 1.5 GHz.
- Multicore coming soon.
- Fast, reliable.
- Synchronizes and centralizes all spectroscopic operations.
- Communications through sockets and USB.

SDAI: Spectroscopic Data Acquisition Interface



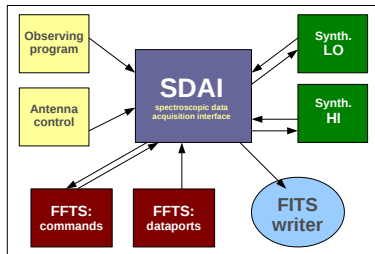
- Developed in python 2.5.
- PyQt4 for Graphical interface.
- Libraries provided: right now, only 1.5 GHz.
- Multicore coming soon.
- Fast, reliable.
- Synchronizes and centralizes all spectroscopic operations.
- Communications through sockets and USB.

SDAI: Spectroscopic Data Acquisition Interface



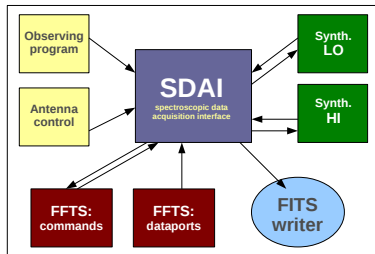
- Developed in python 2.5.
- PyQt4 for Graphical interface.
- Libraries provided: right now, only 1.5 GHz.
- Multicore coming soon.
- Fast, reliable.
- Synchronizes and centralizes all spectroscopic operations.
- Communications through sockets and USB.

SDAI: Spectroscopic Data Acquisition Interface



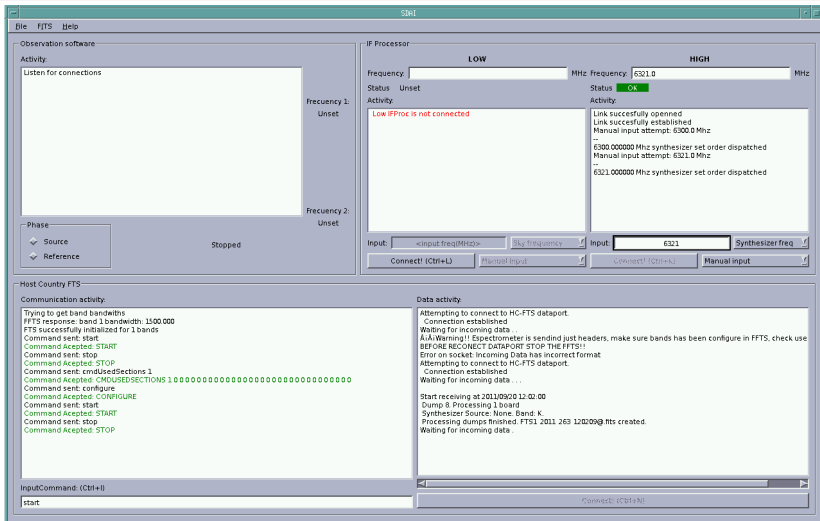
- Developed in python 2.5.
- PyQt4 for Graphical interface.
- Libraries provided: right now, only 1.5 GHz.
- Multicore coming soon.
- Fast, reliable.
- Synchronizes and centralizes all spectroscopic operations.
- Communications through sockets and USB.

SDAI: Spectroscopic Data Acquisition Interface



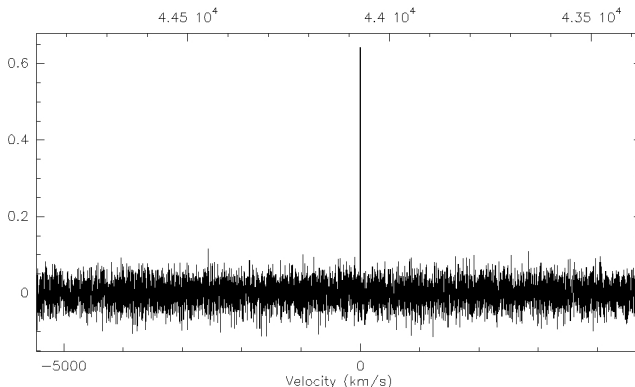
- Developed in python 2.5.
- PyQt4 for Graphical interface.
- Libraries provided: right now, only 1.5 GHz.
- Multicore coming soon.
- Fast, reliable.
- Synchronizes and centralizes all spectroscopic operations.
- Communications through sockets and USB.

SDAI: Snapshot

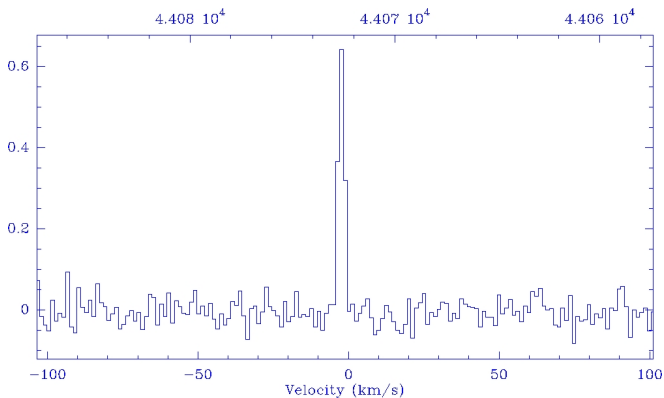


The first light: CH₃OH in DR21-W

2525; 3 DR21-W CH₃OH(7-6) DSS54-Q-FTS1 O:13-AUG-2011 R:10-SEP-2011
RA: 20:37:07.60 DEC: 42:08:46.0 Eq 1950.0 Offs: +0.0 +0.0
Unknown tau: 0.168 Tsys: 276. Time: 15. min El: 76.3
N: 8192 IO: 3808.12 VO: 0.000 Dv: -1.246 LSR
FO: 44069.3670 Df: 0.1831 Fi: 52.7130000

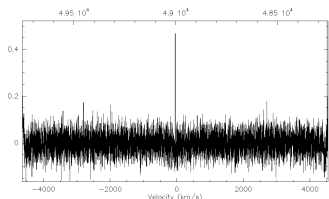


Zoom

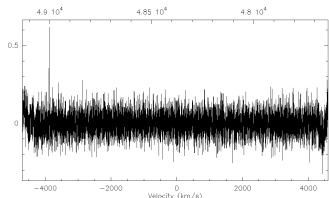


CS in W3(OH): freq & intensity stabilities

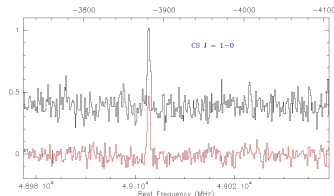
2543: 1 W3OH 48990.955 D5554-Q-FTS1 0:13-AUG-2011 R:13-AUG-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 282. Time: 7.8 min El: 33.6
 N: 8192 IQ: 4096.00 Vb: -48.00 Dv: -1.120 LSR
 FO: 48990.9550 Df: 0.1831 Fi: 0.00000000



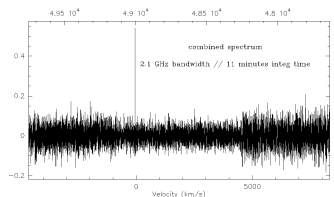
2551: 1 W3OH 48372.456 D5554-Q-FTS1 0:13-AUG-2011 R:13-AUG-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 281. Time: 3.0 min El: 33.2
 N: 8192 IQ: 4096.00 Vb: -48.00 Dv: -1.135 LSR
 FO: 48372.4560 Df: 0.1831 Fi: 0.00000000



2551: 1 W3OH 48372.456 D5554-Q-FTS1 0:13-AUG-2011 R:13-AUG-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 281. Time: 3.0 min El: 33.2
 N: 8192 IQ: 4096.00 Vb: -48.00 Dv: -1.135 LSR
 FO: 48372.4560 Df: 0.1831 Fi: 0.00000000

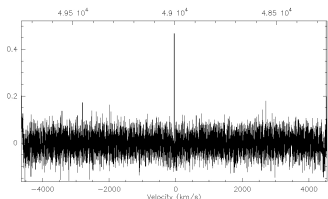


2543: 3 W3OH CS(1-0) D5554-Q-FTS1 0:13-AUG-2011 R:08-SEP-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 282. Time: 11. min El: 33.2
 N: 11571 IQ: 7475.00 Vb: -48.00 Dv: -1.120 LSR
 FO: 48990.9550 Df: 0.1831 Fi: -618.499000

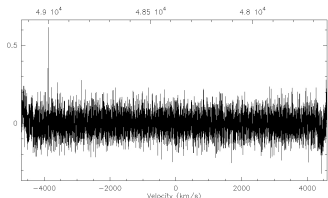


CS in W3(OH): freq & intensity stabilities

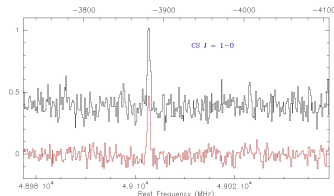
2543: 1 W3OH 48990.955 D5554-Q-FTS1 0:13-AUG-2011 R:13-AUG-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 282. Time: 7.8 min El: 33.6
 N: 8192 IQ: 4096.00 V0: -48.00 Dv: -1.120 LSR
 FO: 48990.9550 Df: 0.1831 Fi: 0.00000000



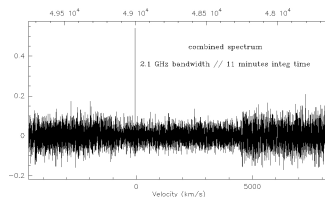
2551: 1 W3OH 48372.456 D5554-Q-FTS1 0:13-AUG-2011 R:13-AUG-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 281. Time: 3.0 min El: 33.2
 N: 8192 IQ: 4096.00 V0: -48.00 Dv: -1.135 LSR
 FO: 48372.4560 Df: 0.1831 Fi: 0.00000000



2551: 1 W3OH 48372.456 D5554-Q-FTS1 0:13-AUG-2011 R:13-AUG-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 281. Time: 3.0 min El: 33.2
 N: 8192 IQ: 4096.00 V0: -48.00 Dv: -1.135 LSR
 FO: 48372.4560 Df: 0.1831 Fi: 0.00000000

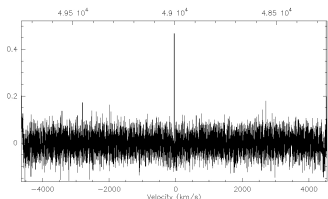


2543: 3 W3OH CS(1-0) D5554-Q-FTS1 0:13-AUG-2011 R:08-SEP-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 282. Time: 11. min El: 33.2
 N: 11571 IQ: 7475.00 V0: -48.00 Dv: -1.120 LSR
 FO: 48990.9550 Df: 0.1831 Fi: -618.499000

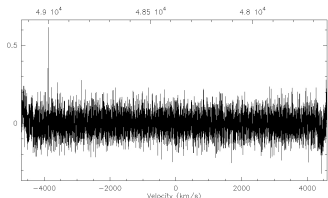


CS in W3(OH): freq & intensity stabilities

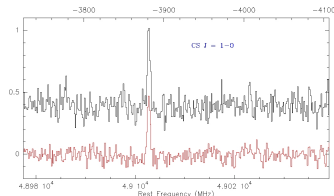
2543: 1 W3OH 48990.955 D5554-Q-FTS1 0:13-AUG-2011 R:13-AUG-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 282. Time: 7.8 min El: 33.6
 N: 8192 IQ: 4096.00 V0: -48.00 Dv: -1.120 LSR
 FO: 48990.9550 Df: 0.1831 Fi: 0.00000000



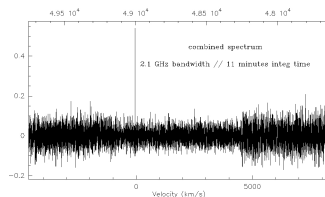
2551: 1 W3OH 48372.456 D5554-Q-FTS1 0:13-AUG-2011 R:13-AUG-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 281. Time: 3.0 min El: 33.2
 N: 8192 IQ: 4096.00 V0: -48.00 Dv: -1.135 LSR
 FO: 48372.4560 Df: 0.1831 Fi: 0.00000000



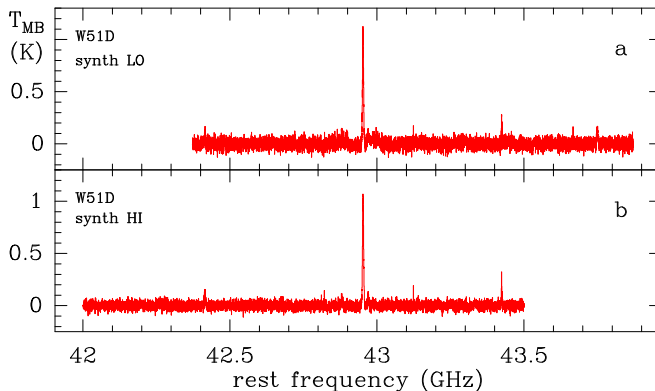
2551: 1 W3OH 48372.456 D5554-Q-FTS1 0:13-AUG-2011 R:13-AUG-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 281. Time: 3.0 min El: 33.2
 N: 8192 IQ: 4096.00 V0: -48.00 Dv: -1.135 LSR
 FO: 48372.4560 Df: 0.1831 Fi: 0.00000000



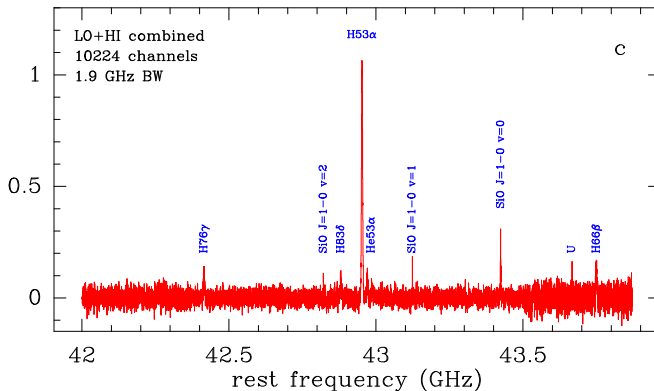
2543: 3 W3OH CS(1-0) D5554-Q-FTS1 0:13-AUG-2011 R:08-SEP-2011
 RA: 02:23:16.50 DEC: 61:38:58.0 Eq 1950.0 Offs: +0.0 +0.0
 Unknown tau: 0.168 Tsys: 282. Time: 11. min El: 33.2
 N: 11571 IQ: 7475.00 V0: -48.00 Dv: -1.120 LSR
 FO: 48990.9550 Df: 0.1831 Fi: -618.499000



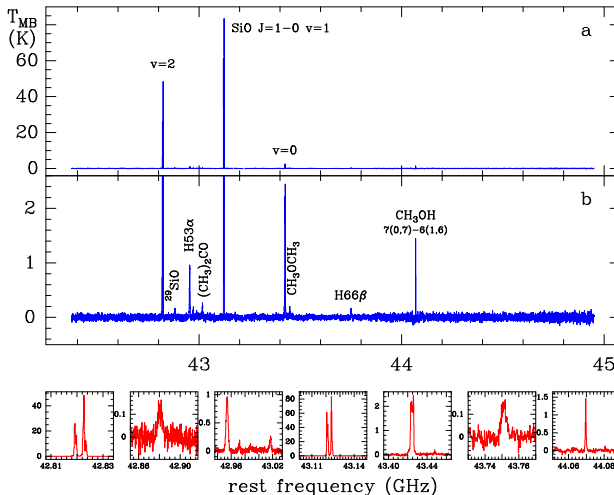
Comparing synthesizers



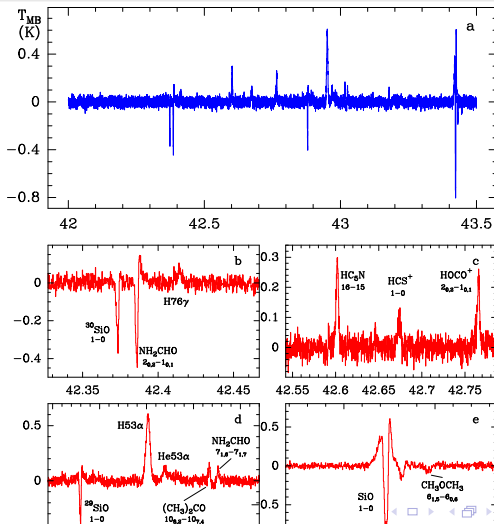
Comparing synthesizers



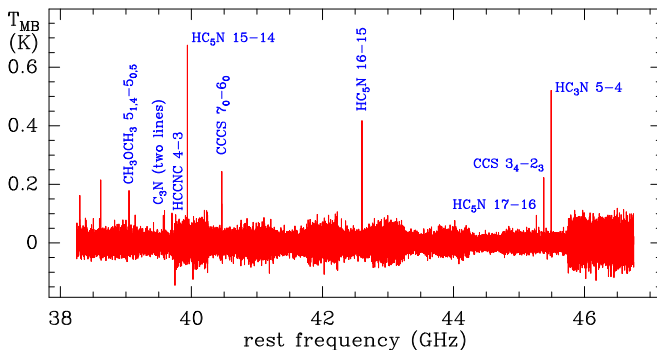
A 2.6-GHz-bandwidth spectrum of Orion KL



Complexity of Sgr B2 in 20 minutes



A 8.5-GHz-bandwidth spectrum of TMC-1



Concluding remarks

- Commissioning results talks about a good facility:
 - Frequency stability
 - Intensity stability
 - LQ and HJ channels in agreement
 - No important spikes
 - Low jitter (depending on signal level)
 - Good for most scientific cases, except perhaps very high fluxes

- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz soon)
 - 2 polarization channels simultaneously
 - 2 frequency channels simultaneously (avoid problems with pointing and calibration)
 - New scientific commissioning
 - HCRA 2012-2013

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds

- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz soon)
 - 2 polarizations simultaneously
 - 2 frequencies simultaneously (avoid problems with pointing and calibration)
 - new scientific cases can be easily addressed

Concluding remarks

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds

- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz max)
 - 2 polarisation channels simultaneously
 - 2 frequency channels simultaneously
 - (avoid problems with pointing and calibration)
 - new scientific capabilities
 - HCRA in Robledo

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds

- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 channels)
 - 2 polarisation channels simultaneously
 - 2 frequency channels simultaneously
 - 1000 channels resolution (avoid problems with pointing and calibration)
 - new scientific capabilities
 - HCRA 2012

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds

- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:

• 100% data acquisition
• 100% data transfer
• 100% data processing
• 100% data storage
• 100% data backup
• 100% data recovery
• 100% data security
• 100% data integrity
• 100% data availability
• 100% data reliability
• 100% data performance
• 100% data quality
• 100% data quantity
• 100% data variety
• 100% data veracity
• 100% data accuracy
• 100% data precision
• 100% data resolution
• 100% data detail
• 100% data depth
• 100% data breadth
• 100% data scope
• 100% data range
• 100% data volume
• 100% data size
• 100% data weight
• 100% data length
• 100% data height
• 100% data width
• 100% data area
• 100% data surface
• 100% data volume
• 100% data mass
• 100% data energy
• 100% data power
• 100% data force
• 100% data pressure
• 100% data temperature
• 100% data humidity
• 100% data light
• 100% data sound
• 100% data smell
• 100% data taste
• 100% data touch
• 100% data feel
• 100% data look
• 100% data sound
• 100% data smell
• 100% data taste
• 100% data touch
• 100% data feel
• 100% data look

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds

- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz soon)
 - 2 polarization simultaneously
 - 2 frequencies simultaneously
 - (avoid problems with pointing and calibration)
 - new scientific cases can be now addressed

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds

- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz soon)
 - 2 polarization simultaneously
 - 2 frequencies simultaneously
 - (avoid problems with pointing and calibration)
 - new scientific cases can be now addressed

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds
- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz soon)
 - 2 polarization simultaneously
 - 2 frequencies simultaneously
 - (avoid problems with pointing and calibration)
 - new scientific cases can be now addressed

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds
- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz soon)
 - 2 polarization simultaneously
 - 2 frequencies simultaneously
 - (avoid problems with pointing and calibration)
 - new scientific cases can be now addressed

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds
- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz soon)
 - 2 polarization simultaneously
 - 2 frequencies simultaneously
 - (avoid problems with pointing and calibration)
 - new scientific cases can be now addressed

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds
- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz soon)
 - 2 polarization simultaneously
 - 2 frequencies simultaneously
 - (avoid problems with pointing and calibration)
 - new scientific cases can be now addressed

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds
- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz soon)
 - 2 polarization simultaneously
 - 2 frequencies simultaneously
 - (avoid problems with pointing and calibration)
 - new scientific cases can be now addressed

Concluding remarks

- Commissioning results talks about a good facility:
 - frequency stability
 - intensity stability
 - LO and HI channels in agreement
 - no important ripples
 - no spikes (depending on signal level)
 - good for most scientific cases, except perhaps cold clouds
- Initial objectives fulfilled
- Significant improvement to HCRA in Robledo:
 - 1.5 GHz bandwidth (3 GHz soon)
 - 2 polarization simultaneously
 - 2 frequencies simultaneously
 - (avoid problems with pointing and calibration)
 - new scientific cases can be now addressed

TO DO list

- TO DO list:

- Implement two independent requesters
- Implement high resolution
- Implement multi
- Baseline behavior and
- Auto removal of
- Improvement of signal
- test

- DONE after commissioning:

- Calibration events
- Parameter change

TO DO list

- TO DO list:

- Implement two independent frequencies
- Implement high resolution
- Implement multicore
- Baseline behavior and spike removal by improvement of signal level
- Optical fiber !!

- DONE after commissioning:

- Calibration constant
- Parameters change

TO DO list

- TO DO list:

- Implement two independent frequencies
- Implement high resolution
- Implement multicore
- Baseline behavior and spike removal by improvement of signal level
- Optical fiber !!

- DONE after commissioning:

- Calibration movement
- Temperature change

TO DO list

- TO DO list:

- Implement two independent frequencies
- Implement high resolution
- Implement multicore
- Baseline behavior and spike removal by improvement of signal level
- Optical fiber !!

- DONE after commissioning:

- Calibration system
- Automation of data

TO DO list

- TO DO list:

- Implement two independent frequencies
- Implement high resolution
- Implement multicore
- Baseline behavior and spike removal by improvement of signal level
- Optical fiber !!

- DONE after commissioning:

- Commissioning completed
- Cold-start commissioning
- Performance check

TO DO list

- TO DO list:

- Implement two independent frequencies
- Implement high resolution
- Implement multicore
- Baseline behavior and spike removal by improvement of signal level
- Optical fiber !!

- DONE after commissioning:

- Cold-start commissioning
- Temperature change

TO DO list

- TO DO list:

- Implement two independent frequencies
- Implement high resolution
- Implement multicore
- Baseline behavior and spike removal by improvement of signal level
- Optical fiber !!

- DONE after commissioning:

- Calibration constant
- Baseline level

TO DO list

- TO DO list:
 - Implement two independent frequencies
 - Implement high resolution
 - Implement multicore
 - Baseline behavior and spike removal by improvement of signal level
 - Optical fiber !!

• DONE after commissioning:

- Calibration of the system
- Commissioning of the system

TO DO list

- TO DO list:

- Implement two independent frequencies
- Implement high resolution
- Implement multicore
- Baseline behavior and spike removal by improvement of signal level
- Optical fiber !!

- DONE after commissioning:

- Cables replacement
- Attenuators changed

TO DO list

- TO DO list:
 - Implement two independent frequencies
 - Implement high resolution
 - Implement multicore
 - Baseline behavior and spike removal by improvement of signal level
 - Optical fiber !!
- DONE after commissioning:
 - Cables replacement
 - Attenuators changed

TO DO list

- TO DO list:
 - Implement two independent frequencies
 - Implement high resolution
 - Implement multicore
 - Baseline behavior and spike removal by improvement of signal level
 - Optical fiber !!
- DONE after commissioning:
 - Cables replacement
 - Attenuators changed

TO DO list

- TO DO list:
 - Implement two independent frequencies
 - Implement high resolution
 - Implement multicore
 - Baseline behavior and spike removal by improvement of signal level
 - Optical fiber !!
- DONE after commissioning:
 - Cables replacement
 - Attenuators changed

Management and timeline

- New backend ready for use with a single frequency and 1.5 GHz bw.
- A period of exclusive exploitation by CAB researchers.
- Open to Spanish Community
- Change to K-band

Management and timeline

- New backend ready for use with a single frequency and 1.5 GHz bw.
- A period of exclusive exploitation by CAB researchers.
- Open to Spanish Community
- Change to K-band

Management and timeline

- New backend ready for use with a single frequency and 1.5 GHz bw.
- A period of exclusive exploitation by CAB researchers.
- Open to Spanish Community
- Change to K-band

Management and timeline

- New backend ready for use with a single frequency and 1.5 GHz bw.
- A period of exclusive exploitation by CAB researchers.
- Open to Spanish Community
- Change to K-band

Muchas gracias, y ...



FELICES FIESTAS !!